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Nos. 87-1022, 87-1112

IN THE
SUPREME COURT OF THE UNITED STATES
OCTOBER TERM, 1987

THE BOARD OF ESTIMATE, THE CITY OF NEW YORK, EDWARD I. KOCH, individually and as Mayor of the City of New York, et. al.,
Appellants,

v.

BEVERLY MORRIS, et. al.,
Appellees.

FRANK PONTERIO,
Appellant,

v.

BEVERLY MORRIS, et. al,
Appellees.

ON APPEAL FROM THE UNITED STATES
COURT OF APPEALS FOR THE SECOND CIRCUIT

BRIEF OF AMICUS CURIAE PROF. JOHN BANZHAF IN PARTIAL SUPPORT OF APPELLANT

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June 13, 1988

QUESTIONS PRESENTED

1. In a reapportionment case involving a municipal body -- here, the New York City Board of Estimate -- in which some voting members are elected at large and others are elected from districts (boroughs), may the court adopt, as a measure of the "voting strength for each voter," a test which ignores the effect on voting power of the at-large members who cast an absolute majority of the total votes on the body; and by so doing prevent municipalities from using at-large district members, flotorial district members, and other techniques to reduce disparities arising from differences in population between the single-member districts?

2. In such a proceeding may the court, without even holding a hearing, dismiss a long-established, scientifically valid, and generally accepted method of computing voting power in many different voting systems, only to mandate one not designed for legislative bodies with both district- and at-large voting members, and which itself fails to satisfy the very criteria the court announced in rejecting the established theory?

TABLE OF CONTENTS

INTEREST AND QUALIFICATIONS OF AMICUS 1

BRIEF STATEMENT OF THE CASE 6

SUMMARY OF ARGUMENT 11

I. AS THE COURT BELOW APPEARS TO ADMIT, NO CONSTITUTIONAL TEST OF CITIZEN VOTING POWER IN REAPPORTIONMENT CASES CAN LOGICALLY AND IN FAIRNESS IGNORE THE EFFECTS OF AT-LARGE LEGISLATORS. 12

II. "CONVENIENCE," "PRECEDENT" WHICH NEVER CONSIDERED THE ISSUE, AND THE ALLEGEDLY DIFFERENT ROLES OF AT-LARGE AND DISTRICT- LEGISLATORS, ARE INSUFFICIENT REASONS FOR REJECTING AN ESTABLISHED ANALYTICAL TECHNIQUE, AND ADOPTING AN UNSUITED ONE WHICH DOES NOT MEET THE COURT'S OWN CRITERIA 18

A. THE BANZHAF INDEX CORRECTLY ANALYZES WEIGHTED VOTING . 21

B. THE BANZHAF INDEX CORRECTLY ANALYZES THE ELECTORAL COLLEGE 24

C. THE BANZHAF INDEX EASILY ANALYZES THE NEW YORK CITY BOARD OF ESTIMATE 33

D. "CONVENIENCE" DOES NOT JUSTIFY IMPOSING AN ARBITRARY TEST OF VOTING POWER 36

E. CASES WHICH NEVER CONSIDERED THE ISSUE DO NOT ESTABLISH PRECEDENT FOR IGNORING THE AT-LARGE LEGISLATORS . . . 42

F. THE ABATE TEST NOT ONLY FAILS TO DEAL WITH AT-LARGE LEGISLATORS, BUT ALSO FAILS TO MEET THE COURT'S OWN CRITERIA . . . 47

G. THE "DIFFERENT INTERESTS" ARGUMENT DOESN'T JUSTIFY EXCLUDING AT-LARGE LEGISLATORS FROM CALCULATIONS OF VOTING DISPARITY 52

III. THE COURT'S DETERMINATION IN WHITCOMB V. CHAVIS WAS NOT THAT THE BANZHAF INDEX WAS INAPPROPRIATE IN DETERMINING VOTING POWER DISPARITIES, BUT RATHER THAT NO SINGLE MATHEMATICAL ANALYSIS -- BY ITSELF -- SHOULD OVERCOME THE PRESUMPTION OF CONSTITUTIONALITY OF A MUNICIPAL VOTING SYSTEM, AND THE FLEXIBILITY TO WHICH LOCAL GOVERNMENTS ARE ENTITLED UNDER OUR FEDERAL SYSTEM 57

APPENDIX I: BANZHAF VOTING POWER INDEX PROCEDURE FOR DETERMINING THE RELATIVE VOTING POWER OF INDIVIDUAL CITIZEN-VOTERS CONCERNING ANY LEGISLATIVE BODY 1001

APPENDIX II: PROF. BRAMS' LETTER . . 1005

APPENDIX III: BANZHAF MATHEMATICAL ANALYSIS OF BOARD OF ESTIMATE . 1006

TABLE OF AUTHORITIES

TABLE OF CASES

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INTEREST AND QUALIFICATIONS OF AMICUS

Amicus John F. Banzhaf III is a Professor of Law at the National Law Center of the George Washington University in Washington D.C. who has previously been involved in numerous legal proceedings concerning issues of interest to the public.[1] He earned a technical degree from M.I.T., has published several technical papers, and obtained two U.S. Patents.

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[1] See, e.g., Banzhaf v. F.C.C., 405 F.2d 1082 (DC Cir. 1968) (Fairness Doctrine applied to cigarette commercials); Capital Broadcasting Co. v. Mitchell, 333 F. Supp. 582 (3-judge, DC 1968) (upholding Congressional ban on cigarette commercials); Action on Smoking and Health v. C.A.B., 699 F.2d 1209 (DC Cir. 1983) (strengthening protections for nonsmoking airline passengers); United States v. Students Challenging Regulatory Agency Procedures (SCRAP), 412 U.S. 669 (1973) (standing to challenge nationwide environmental harm); Campbell Soup Co., 77 F.T.C. 664 (1970) & Firestone Tire & Rubber Co., 81 F.T.C. 398 (1971) (establishing corrective advertising); Banzhaf v. Smith, 588 F. Supp. 1489 & 1498, rev'd on other grounds, 737 F.2d 1167 (DC Cir. 1984) (mandating appointment of "Special Prosecutor"); Agnew v. State of Maryland, 446 A.2d 425 (1982) (recovering, for the state, money unlawfully received).

In law school, Banzhaf developed a technique for measuring voting power[2] based upon principles widely established in the fields of mathematics and political science. He first applied it to weighted voting systems,[3] and proved to scholars in the field,[4] and to New York's

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[2] Now generally known as the "Banzhaf Index." See: Simulation of Weighted Voting: The Banzhaf Index, BYTE, March 1984, at 138; Mathematical Properties of the Banzhaf Power Index, Rand Study; The Banzhaf Index for Multi-Candidate Presidential Elections, presented at the 1981 SIAM National Meeting; discussed in "The Games Scholars Play," Newsweek, Sept. 6, 1982.

[3] See Banzhaf, Weighted Voting Doesn't Work: A Mathematical Analysis, 19 Rutgers L. Rev. 317 (1965).

[4] For example, four of the leading scholars in the field of measuring voting power submitted affidavits supporting Prof. Banzhaf's techniques for analyzing voting power in weighed voting cases. These include Prof. William H. Riker, Chairman of the Department of Political Science at the University of Rochester; Prof. Samuel Krisler, Prof. of Political Science of the University of Minnesota; Dr. Lloyd S. Shapley, Senior Research Mathematician of the RAND Corp.; and Mr. Irwin Mann, Instructor in Mathematics at the Courant Institute of Mathematics at New York University, and consultant to the RAND Corp.

highest court,[5] that previous court decisions which had not used his technique to analyze the distribution of voting power were invalid. Subsequently the technique of analysis was extended, and applied to the Electoral College (for electing the President)[6] where it was widely accepted,[7] to multi-member

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[5] Iannucci v. Board of Supervisors, 220 N.Y. 2d. 244, 229 N.E. 2d. 195, 282 N.Y.S.2d 502 (1967).

[6] Banzhaf, 3.312 Votes, A Mathematical Analysis of the Electoral College, 13 Villanova L. Rev. 303 (1968).

[7] See, e.g., Electoral College Reform, Hearings before the Committee on the Judiciary, House of Representatives, p. 306-74; Election of the President, Hearings before the Subcommittee on Constitutional Amendments, U.S. Senate, p. 517-42, 904-33; Pierce, The People's President, Section O entitled "Computer Analysis of Large versus Small State Power in the Electoral College" at 362 (1968); Michener, Presidential Lottery, Part C entitled "The Banzhaf Studies" at 220 (1969); Editorial, The Washington Post, Dec. 31, 1967; Editorial, The New York Times, Dec. 18, 1968; Editorial, St. Louis Post-Dispatch, Nov. 24, 1968.

districting, and to other voting systems.[8]

As set forth hereinafter in the BRIEF STATEMENT OF THE CASE, Prof. Banzhaf used his technique to calculate the disparities in voting power among voters in the different boroughs of New York City [NYC] under the Board of Estimate, and participated as amicus curiae before the Court of Appeals below.

Amicus Banzhaf argues that the courts below erred in rejecting his and other similar techniques of analysis out-of-hand and without an evidentiary hearing, and in adopting instead one which rules out completely the effect on voting power -- under the current system or any which NYC may try to adopt -- of legislators

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[8] See Banzhaf, Multi-Member Electoral Districts--Do They Violate the "One Man, One Vote" Principle?, 75 Yale L.J. 1309 (1966); Banzhaf, One Man, ? Votes: Mathematical Analysis of Voting Power and Effective Representation, 36 Geo. W. L. Rev. 808 (1968); Banzhaf, Mathematics, Voting, and the Law: The Quest for Equal Representation, Prepared for the International A.P.P. Conference on Mathematical Theory of Committees and Elections, Institute for Advanced Studies and Scientific Research, Vienna.

elected at-large, or from other equal-population districts.

He therefore urges reversal, but takes no position as to whether the current system is constitutional. He suggests, however, that the extent of the voting power disparities, and the justifications for them, should be evaluated under a system or test -- his or some other[9]-- which comports with reality and common sense, with the vast body of scientific learning in the field of the measurement of voting power, and which does not ignore the obvious effect of the at-large legislators on decreasing the disparities in voting power among borough residents.

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[9] For example, another system very similar to the Banzhaf Index, called the "Shapley-Shubik Index," has also been used to evaluate voting power in certain contexts, see Shapley & Shubik, A Method for Evaluating the Distribution of Power in a Committee System, 48 Am. Pol. Sci. Rev. (1954). However, the results obtained using this analysis are very similar to those using the "Banzhaf Index," see Mann & Shapley, Values of Large Games IV: Evaluating the Electoral College by Monte Carlo Techniques (RAND Corp. Memo RM-2651, Sept. 19, 1960); Mann & Shapley, Values of Large Games VI: Evaluating the Electoral College Exactly (RAND Corp. Memo RM-3158-PR, May 1962).

Therefore, he suggests, the Court should reverse the lower courts' finding -- based solely on the Abate test -- that the Board is unconstitutionally constituted. Alternatively, the Court may be able to determine that the Board is unconstitutionally constituted, under either the Abate test or the Banzhaf Index,[10] but require the district court on remand to at least consider methods other than the Abate test in evaluating alternatives which New York City may wish to propose.

BRIEF STATEMENT OF THE CASE[11]

New York City's Board of Estimate is comprised of eight members: three elected at large and casting two votes each on non-budgetary issues,[12] and the

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[10] An analysis of the deviations in voting power under the current NYC Board of Estimate, calculated using the Banzhaf Index, is set forth in note 3, 831 F.2d 384, 386-87; REPRINTED, APPENDIX III.

[11] Because Amicus does not have access to the Joint Appendix or to the record, no references are made to these documents.

[12] On budget matters, the mayor has a veto, but casts no vote.

presidents of each of the five boroughs, each casting one vote. Because the borough of Staten Island has far fewer residents than the other boroughs, the Board was challenged on reapportionment grounds.

The district court initially ruled against the plaintiffs, holding that the Board did not have to comply with the "one man, one vote" mandate because it was neither an elective nor legislative body, 551 F. Supp. 652 (E.D.N.Y. 1981). In reversing that decision, the Court of Appeals directed the lower court to determine on remand:

"whether the combination of at-large and local seats, in the context of the voting procedures of the Board, creates a system of representation that satisfies constitutional standards for instruments of local government," Morris v Board of Estimate, 707 F.2d 687, 690 (2d Cir. 1983) [Emphasis added].

The Court of Appeals was very careful to point out that:

"the fact that three members of the Board are elected at large from the entire city raises novel issues as to how an individual voter's opportunity to elect these members should be assessed in conjunction with his opportunity to elect his borough representative," Ibid., Fn 3. [Emphasis added].

The appellate court also specified exactly what the relevant test and criteria were to be:

"whether 'the guarantee of equal voting strength for each voter [which] applies in all elections of governmental officials is violated by the present electoral scheme.'" Id. at 691. [Emphasis added].

On remand the district court, faced with a bewildering variety of ad hoc and post hoc analyses of the disparities in voting power,[13] each attempting to deal with the unusual legislative situation which combined legislators elected at large with those elected from individual districts [boroughs], adopted the so-called "unmodified Abate test"[14] -- a

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[13] Appellees proposed, in their complaint and initial motion for summary judgment, at least a half dozen different methods for computing the extent of the discrimination they alleged, while intervenor-appellant Ponterio proposed many others.

[14] "[T]he court holds, as to the first stage issues, that the Supreme Court's methodology in Abate v. Mundt, 403 U.S. 182 (1971), is the appropriate standard. . .", Morris v. Board of Estimate, 592 F. Supp. 1462, 1464 (E.D.N.Y. 1984); "The remaining

test said to derive from Abate v. Mundt, 403 U.S. 182 (1971), a case which did NOT involve such a combination. Under this standard, all votes and all voting power related to any at-large Board members must be ignored.[15]

Subsequently, Prof. Banzhaf moved for leave to file a brief amicus curiae setting forth the disparities in voting power analyzed according to his established methodology. However, the district court refused to accept the

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methodological question, then, is whether the Abate test must be modified to account for the at-large representation. . . The court, nonetheless determines conversion unnecessary." Id. at 1470.

[15] As the lower court's calculations and discussion of the issue make plain, so long as the borough representatives have equal voting power, the only factor used in calculating the disparities in citizen voting power is the population of the boroughs. See, e.g., "Simply stated, the question is whether the allocation of an equal number of at-large Council seats to each of the five boroughs, without regard to substantial population disparities, comports with the constitutional rule of substantial numerical equality," Id. at 1466.

brief as untimely,[16] and more than five months later reaffirmed its earlier decision that the effect on citizen voting power of any at-large Board members must be ignored in calculating disparities in voting power.[17]

The Court of Appeals affirmed, holding that the Abate test should be used for reasons of "convenience"; "precedent"; because "at-large members represent voters as city residents"; and because the Banzhaf Index is calculated independently of certain political factors such as party affiliations, Morris v. Board of Estimate, 831 F.2d 384, 386, 390 (2d Cir. 1987). It also purported to base its decision in part on language in this Court's decision in Whitcomb v. Chavis, 403 U.S. 124 (1971), see 831 F.2d 385, 389.

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16 Morris v. Board of Estimate, 647 F. Supp. 1463, n. 1 at 1465 (1986). THE AMICUS BRIEF WAS DATED JUNE 30, 1986.

17 "[T]he Board also can be gauged by the Abate test--irrespective of the at-large representation," Id. at 1468 [emphasis added]; "The at-large representation should be eliminated from the deviation computation," Id. at 1475. THE DISTRICT COURT'S OPINION IS DATED NOVEMBER 19, 1986.

SUMMARY OF ARGUMENT

I. AS THE COURT BELOW APPEARS TO ADMIT, NO CONSTITUTIONAL TEST OF CITIZEN VOTING POWER IN REAPPORTIONMENT CASES CAN LOGICALLY AND IN FAIRNESS IGNORE THE EFFECTS OF AT-LARGE LEGISLATORS. 12

II. "CONVENIENCE," "PRECEDENT" WHICH NEVER CONSIDERED THE ISSUE, AND THE ALLEGEDLY DIFFERENT ROLES OF AT-LARGE AND DISTRICT- LEGISLATORS, ARE INSUFFICIENT REASONS FOR REJECTING AN ESTABLISHED ANALYTICAL TECHNIQUE, AND ADOPTING AN UNSUITED ONE WHICH DOES NOT MEET THE COURT'S OWN CRITERIA 18

III. THE COURT'S DETERMINATION IN WHITCOMB V. CHAVIS WAS NOT THAT THE BANZHAF INDEX WAS INAPPROPRIATE IN DETERMINING VOTING POWER DISPARITIES, BUT RATHER THAT NO SINGLE MATHEMATICAL ANALYSIS -- BY ITSELF -- SHOULD OVERCOME THE PRESUMPTION OF CONSTITUTIONALITY OF A MUNICIPAL VOTING SYSTEM, AND THE FLEXIBILITY TO WHICH LOCAL GOVERNMENTS ARE ENTITLED UNDER OUR FEDERAL SYSTEM 57

I. AS THE COURT BELOW APPEARS TO ADMIT, NO CONSTITUTIONAL TEST OF CITIZEN VOTING POWER IN REAPPORTIONMENT CASES CAN LOGICALLY AND IN FAIRNESS IGNORE THE EFFECTS OF AT-LARGE LEGISLATORS.

If New York City's Board of Estimate were made up only of the five borough presidents, each casting one vote, the disparities in voting power between a resident of Brooklyn (pop. 2,230,936) and of Staten Island (pop. 352,121) would obviously be hugh. On the other hand, as Judge Newman correctly states in his concurrence, no one could logically find disparities of constitutional magnitude if, in addition to the five borough presidents, 100 legislators elected from districts of equal population were added.[18] Presumably the same result would occur if 100 legislators, all elected at large from equal-sized districts, were added to the five borough

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[18] "If a body included 100 at-large members, for example, the existence of one representative from each of five districts [boroughs] of different populations could not seriously be thought to offend constitutional standards." 831 F.2d at 394.

presidents to compose a new larger Board of Estimate.[19]

Yet, under the unmodified Abate test mandated for all district courts in the Second Circuit, the deviations in voting power between citizens of the different boroughs would be as hugh (and presumably as unconstitutional), since the analysis ignores any legislators other than the borough representatives, and is independent of how the voting power is divided on the Board between the at-large

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[19] If there is any doubt that adding 100 legislators, either elected at large or from equally populous districts, would significantly reduce disparities in voting power between residents of the five boroughs, consider a hypothetical (but obviously impractical) Board composed on five borough presidents, and of 100,000 legislators elected from equally-populous districts. Can there be any doubt that, compared with a citizen's ability to affect his representative elected from a micro-district of approximately 70 people, his relative ability to also affect a representative from a district of 352,121 [Staten Island] or 2,230,936 [Brooklyn] is totally insignificant and of no legal consequence!

members and the borough presidents.[20]

Indeed, even in the most extreme situation where all of the borough presidents (together or separately) are totally powerless and the equivalent of nonvoting observers -- i.e., where the 3 at-large members each cast 100 votes, and the borough presidents cast only 1 vote each! -- the majority is willing only to admit that "a different result might be required," and finds "it unnecessary to speculate on the test to be applied in such a case," 831 F.2d 384, n. 5 at 389 [emphasis added]![21]

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[20] Currently, the three at-large Board members cast 2 votes each. Their share of the voting power on the Board can be increased by allowing them each to cast 3 votes, or decreased by allowing them to cast only 1 vote each. Under the Abate test, however, even dramatically increasing the voting power of the at-large members -- in effect, shifting some of it from the borough presidents to the city-wide members -- would have no effect on the calculation of voting power disparities.

[21] Ironically, in the same footnote, the Court of Appeals says of the other cases which likewise have involved a mixture of at-large and district-legislators: "First, the exclusion in each of these cases of at-large members

Such an approach not only flies in the face of logic, common sense, and basic postulates in the fields of mathematics and political science, but is totally unnecessarily, violates the principles of flexibility and federalism, and places local municipal bodies in a reapportionment straightjacket. This Court has said:

"viable local governments may need considerable flexibility in municipal arrangements if they are to meet changing societal needs," Abate v. Mundt, 403 U.S. 184, 185 (1971), quoting Sailors v. Board of Education, 387 U.S. 105, 110-111 (1967) [emphasis added]

"[T]he Constitution and this Court are not roadblocks in the path of innovation, experiment, and development among units of local government." Avery v. Midland County, 390 U.S. 474 (1968). [emphasis added]

Indeed, as the Court of Appeals below itself recognized:

"In connection with the present structure of the Board it is important to recognize that the Supreme Court has repeatedly endorsed innovative approaches to local

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from an analysis of voter inequality--when their inclusion would clearly affect the level of inequality eventually found . ." 831 F.2d 384, n. 5 at 389 [emphasis added].

government, devised by local officials to meet local needs." 707 F.2d 686 at 691.

Yet the effect of this ruling, if affirmed by this Court, would be to prohibit New York City and all other municipal bodies from using innovative approaches such as legislators elected at large, legislators from flotorial districts, and even legislators elected from equal-population districts, to offset whatever disparities there may be when local governmental units (such as boroughs) are each given at least a tiny (and equal) voice on municipal legislative bodies.

By mandating compliance with the unmodified Abate test, denying -- without even a hearing -- the validity of any other possible mathematical justification for the Board of Estimate, and refusing even to speculate on what test might apply even if the City were -- through weighted voting, for example -- to reduce the effective voting power of the borough presidents even to zero, the Court of Appeals goes beyond what the Constitution seems to require to guarantee Equal Protection. Its ruling would effectively

prohibit the city from seeking to remedy the finding of malapportionment by:

1. increasing the number of legislators elected at large;

2. increasing the number of weighted votes allocated to legislators elected at large;

3. adding legislators elected from newly-created single-members districts of equal population, and/or giving them substantial numbers of weighted votes;

4. adding new legislators elected by residents of the six different combinations of boroughs other than Staten Island,[22] and even giving them large numbers of weighted votes;

or by any combination of these and other possible techniques, each of which undoubtedly does reduce the disparity in voting power which now exists between residents of different boroughs.

In short, it is the effect of the decision below establishing one and only one test for constitutionality, and mandating only one out of many techniques

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[22] E.g., Bronx-Queens, Bronx-Brooklyn, Bronx-Manhattan, Queens-Brooklyn, Queens-Manhattan, and Brooklyn-Manhattan.

of compliance,[23] which Amicus suggests is contrary to logic, common sense, and to the need for "flexibility" and "innovative approaches" which this Court has always stressed when dealing with local legislative bodies. Its substantive conclusion that the disparities in voting power under the current system are unconstitutionally large may well be correct, but the extent of such disparities, and the possible justifications for them, should not be judged by this inflexible approach.

II. "CONVENIENCE," "PRECEDENT" WHICH NEVER CONSIDERED THE ISSUE, AND THE ALLEGEDLY DIFFERENT ROLES OF AT-LARGE AND DISTRICT- LEGISLATORS, ARE INSUFFICIENT REASONS FOR REJECTING AN ESTABLISHED ANALYTICAL TECHNIQUE, AND ADOPTING AN UNSUITED ONE WHICH DOES NOT MEET THE COURT'S OWN CRITERIA

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[23] Under the holding, any proposed modification which leaves Staten Island with the same number (and voting power) of representatives on the Board as the other boroughs -- regardless of the number of other Board members, how they are elected, and how many votes they may have -- would be unconstitutional, regardless of whatever some other method of analysis designed to deal with such innovative approaches may show, and regardless of any factual showings made by the City.

The Court of Appeals rejected a more sophisticated and established technique for analyzing voting power in favor of the rigid Abate test in part for "convenience," including a "demonstrated impatience with mathematical metaphysics."[24] In this it no doubt was referring to the lower court's uncertainty in dealing with the effects on voting power of the three at-large legislators:

"Evaluating the effect--if any--of at-large representation on inter-district inequality means speculatively assigning those at-large votes among the districts." 592 F. Supp. at 1473 [Emphasis added] "If that step is taken and the limitation thereby ignored, a deviational figure of doubtful validity is received." Ibid, [Emphasis added]

"[A]ny quantitative method for analyzing the Board that attempts to allocate the citywide members' votes among the boroughs is inevitably arbitrary and ad hoc...the most appropriate methodology for analyzing the representation of individual citizens on the Board...is one which treats the two groups of representatives separately [i.e., "excluding the at-large" (fn 15)]" 592 F. Supp. at 1474, quoting with approval from an affidavit.

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[24] 831 F.2d 384, 386.

But in so doing the district court chooses to ignore -- in part because it was not advanced by either party prior to the first district court decision as to methodology,[25] and in part because a brief amicus curiae bringing it to the court's attention was allegedly filed too late[26] -- a method of analysis which is

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[25] For reasons unclear to Prof. Banzhaf, apparently no party brought the Banzhaf Index to the district court's attention prior to its initial decision concerning the test to be employed, although both sides have used the Banzhaf Index in calculating the distribution of voting power within the Board of Estimate, and although a major article on the mathematics of reapportionment as applied to the New York City Board of Estimate discussed it at length. See Charo, Designing Mathematical Models to Describe One-person One-vote Compliance by Unique Governmental Structures; The Case of the New York City Board of Estimate, 53 Fordham L. Rev. 735 (1985).

[26] Prof. Banzhaf's amicus brief was submitted to the district court on or about June 30, 1986; more than five months before the district court rendered its final decision on Nov. 19, 1986, 647 F. Supp. 1463, n. 1 at 1465.

Although courts have the power to refuse to consider amicus briefs which are not timely, here: (1) the delay was not due to any fault of Amicus Banzhaf

not only clearly NOT ad hoc, but which is well-established and based upon principles long accepted in the relevant disciplines.

A. THE BANZHAF INDEX CORRECTLY ANALYZES WEIGHTED VOTING

It has long been generally accepted in the fields of mathematics[27] and political

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(who was previously unaware of the proceeding); (2) the issues were unusually complicated because of the mathematics involved; (3) this amicus, because of his prior researches, was in a unique position to assist the court; and (4) the proceeding (and therefore the court's ruling) affected not just the immediate parties, but every resident of New York City.

For these reasons, and because both the lower courts and the Supreme Court should avoid making decisions on constitutional issues where the record is incomplete, it is respectfully suggested that Judge Neaher should at the very least have taken some testimony on these very complex mathematical issues.

[27] See, e.g., Kemeny, Snell & Thompson, Introduction to Finite Mathematics 74, 108 (1957); Shapley, Solutions of Compound Games, in Advances in Games Theory 267 (Dresher, Shapley & Tucker ed. 1964); Riker, A Test of the Adequacy of the Power Index, 4 Behavioral Science 120-31 (1959); Shapley, Simple Games: An Outline of the Descriptive Theory, 7 Behavioral Science 59 (1962);

science[28] that "voting power" or "voting strength" means nothing more or less than the ability to affect outcomes by and through a vote. The Court of Appeals in New York has determined that voting power, at least in weighted voting systems, is to be determined in this way.[29] In other words, to determine

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Shapley, A Value for 4-Person Games, 2 Annuals of Mathematical Studies 307 (No. 28, 1953).

[28] See, e.g., David, Goldman & Bain, The Politics of National Party Conventions 174-75 (1960); Schubert, Quantitative Analysis of Judicial Behavior, Ch 4 (1959); Schubert, Judicial Behavior (1964); Krisler, Theoretical Attempts at Predicting Judicial Behavior, 79 Harv. L. Rev. 1573 (1966); Krisler, Power and Coalition on a Nine-Man Body, Am. Behavioral Sci. (Apr. 1963); Riker, Some Ambiguities in the Notion of Power, 58 Am. Pol. Sci. Rev. 341 (1964); Riker, Bargaining in a Three-Person Game, a paper delivered at the 1966 Annual Meeting of the American Political Science Association Sept. 6-19, 1966; Schubert, The Power of Organized Minorities in a Small Group, 9 Ad. Science Q., 133 (1964); Shapley & Shubik, A Method for Evaluating the Distribution of Power in a Committee System, 48 Am. Pol. Sci. Rev. (1954).

[29] Iannucci v. Board of Supervisors, 220 N.Y. 2d. 244, 229 N.E. 2d. 195, 282 N.Y.S. 2d 502 (1967).

voting power, one asks how often a person, by and through his vote (and only by and through his vote) can determine outcomes -- (i.e., has the ability to decide the issue) -- a technique which has been used in many other voting situations.[30]

In the case of legislators (i.e., analyzing voting power within legislative bodies), the model is straightforward, since legislators vote for or against various measures, and a count of their vote determines whether or not the measure passes. All of the parties, and the court below, have accepted this--that the Banzhaf Index is the measure of

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[30] See, e.g., Riker & Hiemi, The Stability of Coalitions on Roll Calls in the House of Representatives, 56 Am. Pol. Sci. Rev. 58 (1962); Krisler, The Power Index, Reapportionment and the Principle of One Man, One Vote, 1965 Modern Uses of Law and Logic 37, 40-43; Mann & Shapley, The A Priori Voting Strength of the Electoral College, in Game Theory and Related Approaches to Social Behavior, (Shubik ed. 1964); Mann & Shapley, Values of Large Games IV: Evaluating the Electoral College by Monte Carlo Techniques (RAND Corp. Memo RM-2651, Sept. 19, 1960); Mann & Shapley, Values of Large Games VI: Evaluating the Electoral College Exactly (RAND Corp. Memo RM-3158-PR, May 1962).

voting power of the individual legislators in the Board of Estimate--and have proceeded accordingly.[31]

B. THE BANZHAF INDEX CORRECTLY ANALYZES THE ELECTORAL COLLEGE

In the case of presidential elections, the model is also straightforward, since citizens vote for electors, and electors

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31 The calculations of voting power among the members of the Board of Estimate (which employs weighted voting) were made using the Banzhaf Index of voting power; the number (and percentage) of combinations in which each legislator can cast a critical or deciding vote. However, although two of the parties and a Law Review author -- see, e.g., Intervenor Ponterio's affidavit dated May 2, 1985 at 5-6; Prof. Steven J. Brams' affidavit dated April 9, 1985, for Plaintiffs; and Charo, Designing Mathematical Models to Describe One-person One-vote Compliance by Unique Governmental Structures; The Case of the New York City Board of Estimate, 53 Fordham L. Rev. 735 (1985) -- purport to apply Banzhaf's principles and/or to make a Banzhafian analysis of voting power under the current Board of Estimate, none have in fact done so correctly.

Indeed, Author Charo, in a telephone conversation with Prof. Banzhaf, admitted that her "Banzhafian analysis" was not based upon Banzhaf's methodology, and that the technique of analysis outlined in this document would probably be more appropriate for the Board of Estimate.

cast their vote in accordance with the majority of votes cast in their states.[32] The voting process is now a two-step one, and each step must be calculated separately.

Thus, for example, to calculate the voting power of citizens of different states under the Electoral College, one first calculates in what percentage of the combinations of electoral votes the votes from any one state will be decisive. This is compared with similar calculations for the electoral votes of the other states.

In essence, this step in the electoral college is nothing more or less than a legislative body employing weighted voting to decide one very important issue, and the voting power of the phantom legislators [electors voting in one block from each state] is calculated the same way that the voting power of the members of the Board of Estimate was calculated.

The second step in this two-step process is to now determine in how many

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32 This is true except in the very rare instance of the "faithless elector."

cases a citizen of any one state (e.g., New York) might cast a vote which would be decisive of how the electoral votes in his state would be cast, and to repeat the calculation for all of the other states. Naturally, citizens of the most populous states have less chance of casting a critical vote in their state than do residents of less populous states.[33]

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[33] It is easy to prove that, in situations where each person has one vote, his or her ability to cast a critical or decisive vote doesn't decrease linearly (proportionately) with the number of people voting. Where the number of persons voting is small, one can calculate by hand the total number of voting combinations, and the number (and percentages) in which each person can cast a critical vote ["CRITICAL VOTING COMBINATIONS"].

For example, if only 3 people vote, and each has only one vote, there are 8 possible voting combinations, and each person can cast a critical vote in 4; i.e., in half of the voting combinations. For somewhat larger numbers still capable of being calculated by hand, the results are as follows:

COL. 1 = # OF PERSONS VOTING
COL. 2 = # OF VOTING COMBINATIONS
COL. 3 = CRITICAL VOTING COMBINATIONS
COL. 4 = % IN WHICH CRITICAL; COL3/COL2

Finally, for voters in each state, the

COL 1	COL 2	COL 3	COL 4
3	8	4	4/8=50%
5	32	12	12/32=37%
7	128	40	40/128=31%
9	512	140	140/512=28%
11	2048	504	504/2048=24%
13	8192	1848	1848/8192=23%
15	32768	6864	6864/32768=21%

As shown above, if the number of voters increases from 3 to 9 (a factor of 3), relative voting power doesn't decrease by a factor of 3 (50/3 = 16.7), but rather approximately by the square root of 3 (1.732): i.e., 50/1.732 = 28.9.

Likewise, if the number of voters increases from 3 to 15, relative voting power doesn't decrease by a factor of 5 (50/5 = 10), but rather approximately by the square root of 5 (2.24): i.e., 50/2.24 = 22.

For larger numbers of voters, voting power can be calculated by using the universally-established Stirling's Formula, and is found to decrease according to the square root of the number of persons voting. For a more detailed explanation, including the precise formulas, see Banzhaf, Multi-Member Electoral Districts - Do They Violate the "One Man, One Vote" Principle, 75 Yale L.J. 1309, 1320-24 (1966); Banzhaf, 3.312 Votes, A Mathematical Analysis of the Electoral College, 13 Villanova L. Rev. 303 (1968); and Whitcomb v. Chavis, 403 U.S. 124, 145 n. 23 (1971).

two figures are multiplied[34] to determine the overall chance any voter has to cast a decisive vote in a presidential election. While the figures are obviously very small -- as they are even in common single-member-district reapportionment cases -- they do represent the relative voting power of citizens in different states, and thus may be directly compared.

Moreover, they do take into account in a systematic and logical manner, based upon a clear and well-defined mathematical model, the two major factors which obviously must be considered in analyzing the electoral college [or any legislative body]: the number of votes each state [or legislator] has compared

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34 To see why the figures should be multiplied, consider this very simple example. There is a raffle with only 20 raffle tickets sold. Thus each ticket has a 1/20 chance of winning. Suppose that one of the tickets is held by a group of six students, who agree that they will roll a die to decide which of the six should own the ticket. Thus, the chance of any one student winning that ticket is 1/6. And the overall odds that any student will win the ticket, AND that the ticket will in turn win the raffle, is 1/20 x 1/6 or 1/120.

with the other states [or legislators], and the number of citizens eligible to vote for each state's bloc of electoral votes [or legislator]. Both are obviously important, since -- at least in the Electoral College calculations -- the relatively smaller chances citizens from a large body have of influencing the outcome in their state can be more than made up by the voting strength of their bloc of votes.[35]

As previously noted, such calculations and comparisons have been generally accepted, and are described

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35 Prior to publications of Prof. Banzhaf's analysis, it was generally believed that voters in more populous states (e.g. New York) had less voting power under the Electoral College than voters in less populous states (e.g. Nevada) because Nevada had more electoral votes per citizen than New York. However, Prof. Banzhaf demonstrated that the ability of voters to affect the way a state's electoral votes would be cast did not drop off proportionately to the population, but rather more slowly according to the square root of the population. Thus, although the number of electoral votes per resident of Nevada is greater than the same measure in New York, New Yorker's enjoyed far greater voting power in presidential elections.

here only in the very briefest and simplified form.

To make the well-studied situation of the Electoral College more analogous to the instant case where citizens vote for four different legislators,[36] suppose

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36 It may be argued that LEGISLATORS, unlike presidential ELECTORS, do not have to vote in accordance with the wishes of the majority of their constituents, and that they even may not always know how their constituents would vote on a particular issue. But it seems that the very essence of the reapportionment "one person, one vote" decision assumes that legislators do tend to act in this general fashion, at least some of the time. If they did not, what difference would it make if one representative came from a district 20% (or even 50%!) more populous than another?

If all that mattered was electing smart or fair-minded persons to the legislature, the residents of the MOST populous district would have an advantage since the chances of finding such a superior person increase with the population of the district. Since it is universally agreed, and the basis of all reapportionment decisions, that persons in MORE populous districts have LESS voting power, the underlying assumption must be that legislators tend to respond to the wishes of a majority of their constituents, at least with regard to some important and well-publicized issues. Thus those in more populous

that somehow (legally or otherwise) a citizen called Mr. X were able to vote in the presidential election in both New York and New Jersey. Using the technique above, we have previously calculated the voting power of voters in both New York and New Jersey under the Electoral College by determining in how many voting combinations a citizen of each state could cast a decisive vote. If Mr. X is able to vote in both states, and presumably to have a chance of casting a decisive vote either in New York or in New Jersey, his voting power would simply

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districts have less chance of influencing legislative decisions.

For studies showing that legislators are very substantially influenced by the views of their constituents, see Cruddle & McCrane, The Linkage Between Constituency Attitudes and Congressional Voting Behavior: A Causal Model, 60 Am. Pol. Sci. Rev. 667-70 (1966); Kornberg, Perceptions and Constituency Influence on Legislative Behavior, 19 West. Pol. Q. 285, 291 (1966); Froman, Congressmen and Their Constituencies (1963); Miller & Stokes, Representation in the American Congress (Prentice-Hall, 1968); Wahlke, Eulau, Buchanan & Ferguson, The Legislative System 273-281; Miller & Stokes, Constituency Influence in Congress, 57 Am. Pol. Sci. Rev. 43, 45-46 (1963).

be the sum of the voting power of citizens of New York and of New Jersey. If he votes in four different states in the presidential elections, his overall voting power will be the sum of the voting power of citizens of each of these states.[37]

As a general rule, then, at least where there are large numbers of voters, the voting power of any individual citizen voter is simply the sum of his voting power calculated with respect to legislator A, plus the sum of his voting power with respect to legislator B, and

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[37] Consider the simple example of the raffle with 20 raffle tickets discussed in an earlier footnote. If any given student is eligible to win a raffle from two different groups each consisting of 6 students, then his overall chances of winning the raffle are the sum of his chances with regard to either of the tickets. If one ticket is owned by six students who agree to award it at random to one of their number; another ticket is owned by four students who likewise agree to award it at random to one of their members; and student Y is a member of both groups -- one may still calculate all of the possible combinations; determine in how many he can win with ticket A or ticket B; and calculate his overall chances of winning by ADDING both figures.

so on with regard to each and every legislator for whom he is eligible to vote. This simple methodology, described in very simple and general form in Appendix I, is valid for virtually all plans no matter how complex, and yields the expected results in simple systems such as single-member districts of unequal population.

C. THE BANZHAF INDEX EASILY ANALYZES THE NEW YORK CITY BOARD OF ESTIMATE

Turning now to the New York City Board of Estimate, it is obvious that each resident of New York City has some voting power arising out of his ability to vote in elections for the three at-large members, and that this is the same and therefore equal for all residents. To calculate the voting power each resident has with respect (for example) to the Mayor, one need only take the voting power of the Mayor and divide it by the square root[38] of the voting population of

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[38] The reason for using the square root of the population, rather than the population itself, was previously explained; where large numbers of voters are involved, the ability to cast a decisive or critical vote decreases as

the entire city. The same technique can be used to calculate the voting power each resident has with respect to the other two at-large members of the Board. All are obviously the same, since the populations eligible to vote for each at-large legislator are the same.

It is also obvious that each resident also has some voting power arising out of his ability to vote in elections for his borough president, and that this voting power is LARGEST in the LEAST populous borough. To calculate it for residents of each borough, one need only take the voting power of the borough president (which is equal to that of all other borough presidents, but less than that of any of the three at-large members who

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the square root of the number of voters. However, even assuming for the sake of argument that it decreased according to the population, or to the square, or to the natural logarithm of the population, there would be no excuse for ignoring the voting power attributable to the three at-large members of the Board, as the lower courts did. In any event, no one has come forth with a competing mathematical model, or even a cogent argument, suggesting that the decrease in voting power is NOT proportional to the square root.

each have two votes) and divide it by the square root of the population of the particular borough.

Since each resident has voting power by virtue of being able to help elect four different people, the voting power of citizens in the most populous and least populous boroughs can be calculated and compared as follows:

<u>VOTING POWER OF BROOKLYN VOTER</u> = (Voting Power of Mayor)/(Square Root of City Population) + (Voting Power of Comptroller)/(Square Root of City Population) + (Voting Power of President)/(Square Root of City Population) + (Voting Power of Borough President)/(Square Root of Brooklyn Population).

<u>VOTING POWER OF ST. ISLD VOTER</u> = (Voting Power of Mayor)/(Square Root of City Population) + (Voting Power of Comptroller)/(Square Root of City Population) + (Voting Power of President)/(Square Root of City Population) + (Voting Power of Borough President)/(Square Root of St. Island Population).

Naturally, the voting power of the resident of Staten Island is GREATER than the voting power of the resident of Brooklyn because the population of Staten Island is far LESS than that of Brooklyn. However, the first three terms of the

equations are the same for both voters. Only the last term is different. Amicus respectfully suggests that the lower court erred in refusing to recognize any of the first three terms, and by insisting that the degree of disparity must be calculated solely on the basis of the borough representative, i.e., only by looking at the last term.

D. "CONVENIENCE" DOES NOT JUSTIFY IMPOSING AN ARBITRARY TEST OF VOTING POWER

Thus the courts below are wrong in suggesting that "convenience" requires the application of the unmodified Abate test in order to avoid ad hoc problems of allocation of voting power and multiple self-serving analyses by the parties. On the contrary, as this brief has demonstrated, there already exists a well-recognized, established, and consistent body of mathematical and political science techniques for measuring voting power; ones which were established long prior to the initiation of the instant challenge to the Board, not by partisans representing one side or the other, but rather by totally independent experts in the field. They

can be used easily and objectively to determine the disparities in voting power in virtually any legislative situation.

In essence, the analysis consists of two different parts. If the legislators cast different numbers of votes (as under weighted or fractional voting), a simple computer analysis, using a program readily available to the public,[39] calculates the number of combinations in which each legislator may cast a "critical" or deciding vote, and uses that to calculate his legislative voting power. This is already the law in New York State,[40] and all parties used this technique to analyze voting power among the members of the Board of Estimate.

The second step is to divide the voting power of each legislator by the square root of his constituency to obtain the voting power each voter has by virtue of being able to vote for any single legislator. Then the voting power of a

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[39] See: Simulation of Weighted Voting: The Banzhaf Index, BYTE, March 1984, at 138.

[40] Iannucci v. Board of Supervisors, 220 N.Y. 2d. 244, 229 N.E. 2d. 195, 282 N.Y.S.2d 502 (1967).

citizen in any district or borough can be obtained by simply adding the voting power he has by and with respect to each legislator for which he is entitled to vote. This second step can be done -- as it was in fact done in this proceeding by Prof. Banzhaf -- on a simple hand calculator! The results are impartial and objective, and permit direct comparison of the disparities in voting power under many different kinds of legislative systems.

In any event, mere "convenience" in the application of a test can never justify striking down an electoral system which actually provides substantial equality of representation: e.g., a reconstituted Board of Estimate composed of the five borough presidents, and 25 legislators elected from equally-populous districts.

The courts' convenience, particularly in a federal system, is not a sufficient basis for denying municipal governments the "flexibility" to which they are constitutionally entitled, Abate v. Mundt, 403 U.S. 184, 185 (1971), nor for creating "roadblock[s] in the path of innovation, experiment, and development

among units of local government," Avery v. Midland County, 390 U.S. 474 (1968).

Complex voting systems, such as the Electoral College or New York City's Board of Estimate, naturally may require more complicated techniques of analysis than simply comparing the populations of the boroughs, and the number (and number of votes) of borough representatives, as the Abate test implies. Indeed, the simple-minded approach the courts below adopted can easily lead to absurd results.

For example Charo, author of a scholarly mathematical analysis of the Board of Estimate;[41] Prof. Steven Brams, whose expert mathematical testimony was cited by the lower court;[42] and City Council President Andrew Stein have all proposed different schemes of weighted voting which each claim will very substantially reduce the inequalities in

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[41] Charo, Designing Mathematical Models to Describe One-person One-vote Compliance by Unique Governmental Structures; The Case of the New York City Board of Estimate, 53 Fordham L. Rev. 735, 776 (1985).

[42] 647 F. Supp 1463, 1476-77.

voting power under the current system. The latter plan, as shown below, in addition to very substantially increasing the voting power of the three at-large members, allocates to each borough president a number of weighted votes approximately proportional to the population [POP] of his borough.

Thus, under the unmodified Abate test and the lower courts' analysis, it should comport with the constitutional requirements, and virtually eliminate the disparities in voting power of which the plaintiffs below complained.

BOROUGH	# OF VOTES	POP	POP/VOTE
Brooklyn	11.3	2,230,936	197,428
Queens	9.6	1,891,325	197,013
Manhattan	7.3	1,427,533	195,566
Bronx	6.0	1,169,115	194,853
St. Island	1.8	352,121	195,623
Mayor	35.0		
Comptroller	35.0		
CC President	35.0		

However, as Prof. Brams has noted in a letter dated Oct. 28, 1987 and published in the New York Times, such an allocation of voting power -- although in apparent compliance with the Abate test -- would in fact make no difference whatsoever in the allocation of voting power! As he

correctly demonstrates, although the borough president from Brooklyn has more than six times the number of votes as the borough president from Staten Island--each in proportion to their respective populations -- each borough president has exactly the same voting power!

Thus the voting power disparities of which the plaintiffs below complained -- because the representative from Staten Island had the same voting power as the representative from the other much larger boroughs -- remain totally unchanged. As Prof. Brams correctly explains:[43]

"To obtain a simple majority of 71 of the 141 votes, two citywide officials and any one of the borough presidents could form a winning coalition; or one citywide official and all the borough presidents could form a winning coalition.

In either case, whether a borough president has 1.8 votes, 11.3, or anything in between, makes absolutely no difference in his or her ability to be a member of a winning coalition.

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[43] A copy of his letter is included as APPENDIX II for the convenience of this Court. Although not part of the record, the Court may presumably take judicial notice of the correctness of his conclusions, as they can be verified by a simple pencil-and-paper analysis.

This renders all borough presidents, despite their different weights, equally powerful in forming a winning coalition. Indeed, if the 36 votes were divided by 5 to give them 6.6 votes each, the possible winning coalitions would be exactly the same as under the Stein proposal."

On the other hand, so long as the more-soundly based calculations rested upon the Banzhaf Index can be performed easily and objectively by all involved, and provide results which are far more consistent with accepted principles of voting power and with common sense (unlike those directly above), the Constitution does not empower the courts to straightjacket legislative innovation in the name of mere "convenience"!

E. CASES WHICH NEVER CONSIDERED THE ISSUE DO NOT ESTABLISH PRECEDENT FOR IGNORING THE AT-LARGE LEGISLATORS

The district court below cites a number of cases involving legislative bodies, which also contained members elected at large combined with those elected from districts, and notes that in those decisions, comparisons concerning voting power are made only between and with regard to the legislators elected from districts. This, the Court of Appeals argues, creates precedent for adopting

the unmodified Abate test to measure disparities in voting power in bodies consisting of both at-large and district-members.

But virtually all of these are lower court decisions where the issue never even came up! Indeed, as the district court itself candidly concedes:

"[T]o be sure, in Oliver and Andrews as well as in the cases cited from other jurisdictions, whether to exclude the at-large representation was not an explicit issue," 592 F. Supp. at 1472 [Emphasis added].

Moreover, some of the cited opinions suggest that borough or district residents were treated the same as other at-large members only because they--unlike New York's borough representatives -- actually represented all of the electorate. Thus in Dusch v. Davis, 387 U.S. 112, 115-16 (1967), the Court notes:

"Each of the 11 councilmen is elected by...all of the electors in the city...If a borough's residents on the council represented in fact only the borough...,different conclusion might follow. [Emphasis added]

Similarly, in Fortson v. Dorsey, 379 U.S. 433, 438 (1965), the Supreme Court remarked that:

"Each district's senator must be a resident of that district, but since his tenure depends upon the county-wide electorate he must be vigilant to serve. . .all the people in his county. . .; thus he is the county's and not merely the district's senator." [Emphasis added]

In summary, in all of the cases cited as "precedent" in the courts below, the issue of how to include the effect of legislators elected at large in the calculations of voting power disparities apparently never came up. In part this may have been because it never occurred to the parties or to the court,[44] and in

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[44] There is a remarkable parallel here with the situation in New York State, where court after court had upheld weighted voting systems simply because they found that legislators were permitted to cast a number of votes proportional to the populations of their districts. But despite this "precedent," the New York Court of Appeals did not hesitate to rule that calculations based upon the Banzhaf Index had to be made in considering such plans. Iannucci v. Board of Supervisors, 220 N.Y. 2d. 244, 229 N.E. 2d. 195, 282 N.Y.S.2d 502 (1967).

Even more remarkable, the New York Court of Appeals learned of the Banzhaf Index only after argument in the case was heard when the author filed a brief amicus curiae, and adopted it without any

part because the influence of the at-large members was so small that it did not appear likely to significantly affect the calculations of voting disparities.

As another mathematician-lawyer writing specifically about this case noted:[45]

"[N]one of these cases have presented a situation in which at-large representatives have a majority voting bloc. This is a significant qualitative difference in the organization of the Board's voting structure."

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evidentiary hearing or even argument by counsel. In contrast, the district court here refused to admit the author's brief amicus curiae as to the methodology, or to hold any evidentiary hearings before rejecting it out of hand.

On the basis of this very scarce record, the Court of Appeals affirmed; and the Supreme Court is now asked to rule on an important Constitutional issue which will establish an inflexible standard for all local municipal bodies which admittedly refuses to consider the effect at-large legislators (and, by inference, those elected from single-member districts) obviously have on overall voting power.

[45] Charo, Designing Mathematical Models to Describe One-person One-vote Compliance by Unique Governmental Structures; The Case of the New York City Board of Estimate, 53 Fordham L. Rev. 735, 776 (1985) [emphasis added, footnote omitted].

Unfortunately the Court of Appeals seems to have misunderstood the significance of this difference, saying:

"there is no principled reason . . why different basic theories of equal protection should apply depending on the size of the at-large membership. 831 F.2d 384, 389 [emphasis in original]

But analysis under the Banzhaf "theory" proceeds the same way whether the size and/or voting power of the at-large membership is large or small.

If the voting power of the at-large members is large, its impact on reducing disparities in voting power among voters of different single-member districts will be significant and must be considered, as will be shown using the Banzhaf Index. On the other hand, where the voting power of the at-large members is small, its impact can still be precisely determined by using the Banzhaf Index, but it may be so tiny that it makes no significant difference in the calculation of the disparities, and thus may be ignored.

In other words, the earlier cases cited as "precedent" may have ignored the at-large legislators, not because situations where the at-large members have a small minority of voting power require one

technique of analysis, and situations where the at-large members have a substantial majority of voting power require another, but rather because in the former situation the effects on the disparity calculations are not legally significant.

F. THE Abate TEST NOT ONLY FAILS TO DEAL WITH AT-LARGE LEGISLATORS, BUT ALSO FAILS TO MEET THE COURT'S OWN CRITERIA

The Court of Appeals suggests, as reasons for rejecting the Banzhaf Index in favor of the unmodified Abate test, that the former does not reflect "voter motivation," and ignores factors such as "ingrained partisan preferences," "voting habits," and the "tradition of 'collegiality,'" 831 F.2d 384, 390-91. But these are hardly valid criticisms, and the Abate test has the same -- and many other -- problems.

First, voter motivation has never been considered the test -- or even an appropriate criteria -- in reapportionment cases. In many cases of unequally-populated single-member districts, residents of the LESS populous district may still be LESS motivated to vote than those in the more populated

districts because one party clearly dominates the district, the population and/or their interests are too homogeneous, the legislator is solidly entrenched in office, or for other similar reasons. Yet no such showings would prevent a court from ruling that the residents of the UNDERpopulated district have MORE voting power, and of ordering reapportionment if the disparities exceeded certain levels.

Moreover, if "voter motivation" is an important factor in measuring voting power, we should logically expect that voter turnout in elections for borough president in New York should DECREASE as the population of the borough INCREASES; that since residents of Queens, for example, have far less voting power than residents of Manhattan and the Bronx, voter turnout there should be less.

Yet official figures -- of which this Court may take judicial notice -- for the 1986 populations of the five boroughs, and for the number of voters [TURNOUT] in

the last election,[46] demonstrates that no such simple correlation between voter motivation and voting power exists.[47]

BOROUGH	POPULATION	TURNOUT	% TURNOUT
Brooklyn	2,293,200	268,045	11.69%
Queens	1,923,300	275,300	14.31%
Manhattan	1,478,000	204,927	13.87%
Bronx	1,193,600	139,705	11.70%
St. Islnd	324,600	76,058	23.43%

Perhaps, as the Court of Appeals itself suggests, voter motivation has little to do with voting power: "One votes because he thinks it his duty as a citizen or because he feels social pressure to do so or because he finds a symbol of inclusion

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[46] 1986 Provisional Statistics, U.S. Census Bureau; and New York City Board of Elections, Statement and Returns.

[47] The results are virtually the same when the older population figures-- those used by the lower courts -- are used instead of the more recent census data. Although "voter motivation," as measured by voter turnout, is in fact highest in Staten Island where voting power is greatest, there is no corresponding correlation in the other four boroughs. Thus the higher turnout in Staten Island could have been caused by many factors such as a more charismatic candidate, an important local issue, etc.

in the act,"[48] all motivations which have nothing whatsoever to do with the degree of malapportionment!

Naturally the Banzhaf Index, like the unmodified Abate test, does not take into account "ingrained partisan preferences," "voting habits," the "tradition of 'collegiality,'" or other similar factors in determining voting power, for several very good and sufficient reasons. First, permitting evidence concerning such factors to be introduced into reapportionment cases, and requiring the courts' calculus of voting power disparities to factor them in, would create impossible problems, and push the courts even further into a quagmire.

Second, these matters have a habit of being temporary and transitory, so that a plan upheld in one suit based upon such factors might have to be reconsidered shortly thereafter in subsequent suits.

Finally, the whole purpose of the "one man, one vote" cases is to equalize the "rules of the game" -- i.e., the allocation of voting power inherent in

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[48] 831 F.2d 384, 390, quoting from other authorities.

the rules for voting[49] -- and not the way the voting power is actually used in practice. To attempt to do anything more, and to require any test of voting power disparities to include factors such as "collegiality" and "partisan preferences" as the Court of Appeals suggests, would force the courts to intrude far beyond their limited role of insuring that citizens have approximately

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[49] For example, no one would seriously doubt that in the U.S. Supreme Court all justices have equal voting power, since each can cast one and only one vote. This is true although factors such as an individual justice's seniority or personal persuasiveness, or temporary ideological divisions on the Court, may mean that one justice is more "powerful" in some sense, or able to influence more crucial decisions, than another. Similar factors, of course, may likewise affect the distribution of power in a body where legislators, each casting one vote, come from single-member districts of identical population. No system of allocating voting power among justices (or legislators) could hope to eliminate these differences (even in the short run), any more than this Court should seek to deal with such factors in fashioning the voting rules, or the tests for voting power, for municipal voting bodies.

equal voting power.[50] In any event, since the Abate test likewise does not take into account these various factors, these are not valid arguments for accepting it and rejecting the Banzhaf Index, particularly since the Abate test admittedly cannot and does not take into account the obvious effect of the at-large board members who cast a majority of the total number of votes.

G. THE "DIFFERENT INTERESTS" ARGUMENT DOESN'T JUSTIFY EXCLUDING AT-LARGE LEGISLATORS FROM CALCULATIONS OF VOTING DISPARITY

Finally, the Court of Appeals argues that the at-large members of the Board must be omitted from the analysis of

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50 "These are not right-to-vote cases, even though voting is involved. They are representation cases; i.e., they are cases concerning the most interesting, the most complex, the most baffling aspect of any democratic political system, namely, the ascertainment of public feeling on innumerable public policy issues through the medium of periodic, partisan selection of district delegates to a multimembered representative assembly." Dixon, Reapportionment Perspective: What is Fair Representation, 51 A.B.A.J. 319 (1965), reprinted in Cong. Rec. 10601 (daily ed. May 19, 1965).

disparities in voting power,[51] even though they cast a majority of all of the votes on the Board, because they "represent different interests." The majority cites the issue of a proposed toxic waste dump, where placement in Brooklyn would best serve the interests of most New Yorkers, but where the representative from Brooklyn would likely wish to oppose it.[52]

However, this simplistic example ignores several crucial points. First, the presidents of all of the other boroughs, as well as the three at-large members, are likely to support locating a dump in Brooklyn rather than somewhere else in the city. So, with regard to such local issues as site selection, the roles and interests of the at-large members are likely to be identical to all but one of the borough presidents! The SIMILARITIES of interests and roles, rather than the differences, predominate.

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51 ". .we hold that in calculating voting equality for equal protection purposes the citywide members should be, if not ignored, not considered in the appropriate analysis," 831 F.2d 384, 392.

52 831 F.2d 384, 391-392.

This becomes ever clearer if we imagine a hypothetical new Board of Estimate composed of three at-large members, one representative from Staten Island, and a representatives elected from districts in each of the other four boroughs; each such district roughly equal in population to the population of Staten island. This is a Board which undoubtedly would satisfy the demands of the plaintiffs below, and meet the Abate test.

Yet here also it can reasonably be expected that, while the representative from the district including the proposed dump site will oppose it, most or all of the other representatives from other districts in Brooklyn, like the representatives from the other boroughs and the at-large members, will vote FOR it. In other words, the interests of all but one of the district representatives will coincide with the interests of the city-wide members. There is thus no justification for treating them separately or differently -- or indeed,

for totally overlooking them -- in the voting power calculations.[53]

The crucial question must be whether, with regard to site location and other issues, the residents of Staten Island

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[53] As another simple illustration, consider a hypothetical Board of Estimate like the existing one, but where the three members casting two votes are not elected at large, but rather are elected from three equally populous districts into which the entire city have been divided. Here the interests of the three are clearly regional rather than citywide -- i.e., more like the borough presidents than the three current members elected at large --yet the unmodified Abate test would still ignore their effect upon voting power.

Similarly, consider a hypothetical Board made up of five borough presidents each casting one vote, and six legislators elected from equal-size districts, and each casting one vote. Here the interests of the six district members would be at least as "regional" or narrow as those of the five borough presidents, yet the unmodified Abate test would seemingly still ignore their effect on overall voting power disparities.

Indeed, even doubling their voting power, so that the six regional members together have 12 out of a total of 17 votes, or tripling their voting power, so that the borough presidents have only 5 votes out of a total of 23, would not under the lower courts' analysis decrease the disparities in voting power by one iota!

have an UNCONSTITUTIONALLY greater (not simply greater) say in where the dump will be located. No one doubts that their say is greater than that of residents of other boroughs, since their borough president is responsible to a smaller constituency than the presidents of other boroughs. However, since the Constitution does not require that voting power be exactly equal, and since this Court has repeatedly said that the flexibility municipalities are entitled to under our Federal system may result in some inequalities in voting power, the question in cases such as this is whether the inequalities are within the limits the constitution permits.

The answer lies not in overlooking the overall effect of some members of the Board, and pretending that the interests of the other borough presidents are so different that their 6 out of 11 votes must be ignored. Rather it lies in calculating with precision the chance residents of Brooklyn have to influence crucial legislative decisions -- which may include the location of toxic dumps-- compared with the chances residents of

Staten Island have in affecting those same decisions.

III. THE COURT'S DETERMINATION IN WHITCOMB V. CHAVIS WAS NOT THAT THE BANZHAF INDEX WAS INAPPROPRIATE IN DETERMINING VOTING POWER DISPARITIES, BUT RATHER THAT NO SINGLE MATHEMATICAL ANALYSIS -- BY ITSELF -- SHOULD OVERCOME THE PRESUMPTION OF CONSTITUTIONALITY OF A MUNICIPAL VOTING SYSTEM, AND THE FLEXIBILITY TO WHICH LOCAL GOVERNMENTS ARE ENTITLED UNDER OUR FEDERAL SYSTEM.

In the companion cases of Whitcomb v. Chavis, 403 U.S. 124, and Abate v. Mundt, 403 U.S. 182, both decided June 7, 1981, the Court faced two different "one man, one vote" challenges to non-federal legislative systems. In Abate this Court upheld the plan despite admitted inequalities in voting power, stressing the value of "close cooperation between the county and its constituent towns," id. at 186, "the advantages of having the same individual occupy the governing positions of both the county and its towns," ibid., and reaffirming that "viable local governments may need considerable flexibility in municipal arrangements if they are to meet changing societal needs," id. at 185 [emphasis added].

All of these arguments appear to apply as well to the instant situation. Moreover, there was no hint in the Abate opinion that the test the Court utilized to uphold the plan, a plan which involved only legislators elected from individual districts and NOT at large, should be used in situations involving a mixture of legislators elected at-large and from separate districts.

In Whitcomb the Court faced several challenges to multi-member districts, including one based upon the Banzhaf Index. This Court did not question the mathematical analysis,[54] but concluded

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54 "The District Court did not quarrel with plaintiffs' mathematics, nor do we," Id. at 145; "The only relevant difference between the elementary arithmetic on which the Court relies, and the elementary probability theory on which Professor Banzhaf relies, is that calculations in the latter field cannot be done on one's fingers," Id. at 168, n. 2 (Opinion of Harlan, J.).

Justice Harlan is incorrect, however, when he says that the Banzhaf technique ASSUMES that the probability of voting for candidate A over candidate B is 50%, or that the calculation of voting power is affected by varying this assumption, Id. at 169. The Banzhaf Index postulates only that, a priori, all voting combinations are equally significant (NOT

that a mathematical test, by itself, and without sufficient additional factual support in the record,[55] was insufficient not only to overcome plaintiffs' heavy burden, but also to overturn a line of precedent where the issue of the alleged unconstitutionality of multi-member

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equally likely).

In other words, when formulating a voting body by assigning the number of votes each legislator is to have, and the size of the district (or at-large) from which he is to be elected, it is impossible to predict that any particular voting combination is more likely to come up, or that it will come up with regard to more important issues. Thus, in fairness, all possible results or outcomes must be considered equally significant, and given equal weight.

55 "The real-life impact of multi-member districts on individual voting power has not been sufficiently demonstrated, at least on this record, to warrant departure from prior cases." Id. at 146. "The theory that plural representation itself unduly enhances a district's power and the influence of its voters remains to be demonstrated in practice and in the day-to-day operation of the legislature. Neither the findings of the trial court, not the record before us, sustains it, even where bloc voting is posited." Id. at 147. [emphasis added]

districts had been "squarely presented" but rejected by the High Court.[56]

Here is situation is very different. In Whitcomb the plaintiffs, solely on the basis of a mathematical theory, asked the Court to strike down a line of precedent where the issue had been "squarely presented"; and to render a decision which would have impacted the overwhelming majority of state legislatures[57] and outlawed a system which had been in effect since colonial times.[58]

In the instant proceeding, the question of measuring disparities in voting power in a mixed system of at-large and district- legislators has apparently never been directly addressed by any court, much less "squarely presented" to

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56 "Subsequently, when the validity of the multi-member district, as such was squarely presented, we held that such a district is not per se illegal under the Equal Protection Clause." Id at 142. [citations omitted].

57 "As of November 1970, 46% of the upper houses and 62% of the lower houses in the States contained some multi-member districts," Id. at 157, n. 37.

58 Id. at 158.

the Supreme Court. Plaintiffs below, brandishing nothing more than their own mathematical test -- which admittedly was not fashioned by this Court for this type of situation; does not meet the Court of Appeal's own criteria; and totally ignores the effect of the at-large Board members -- seek to overcome the presumption of constitutionality, and a technique of analysis which is firmly grounded in the relevant disciplines, without any hearing or evidentiary record.

More precisely, it appears that Plaintiffs have produced no evidence to support their mathematical theory that the majority of the Board's voting power held by the at-large members doesn't decrease the disparities. It has also been shown that "voter motivation," a major empirical factor discussed by the Court of Appeals, contradicts their allegations of major disparities; that several weighted voting plans which seemingly follow the Abate formula would -- as Plaintiffs' own expert admits -- be no better than the current system; and that adoption of this test would very significantly and unnecessarily limit the

ability of local governments to provide a flexible response to local conditions and problems.

As this Court well knows, a statistical or mathematical analysis is usually never completely right nor completely wrong. Rather, the weight it is to be accorded depends on how consistent it is with other accepted principles; the extent to which it is or can be supported by empirical evidence; how closely its assumptions or postulates correlate with the reality it purports to measure, etc.

In other words, a court may well find the weight of a particular study insufficient to overcome a strong constitutional presumption and a well-established line of cases, and yet find it sufficiently persuasive to serve as a defense to a constitutional challenge. For example, although this Court found a study of racial bias insufficient -- by itself, and without additional empirical evidence -- to support a constitutional challenge to the administration of the death penalty in McCleskey v. Kepk, 107 S.Ct. 1756 (1987), it undoubtedly would have given significant weight in a case

alleging racial bias to such a study if its results were to the contrary.

Here the same principle applies. Whitcomb provides no support for refusing to even consider -- and to hold a brief hearing concerning -- a major study which is being used to DEFEND rather than attack a municipal voting system, particularly when plaintiffs offer nothing other than their mathematical test which not only likewise lacks empirical foundation, but totally ignores the effect of at-large members, and seemingly validates weighted voting "solutions" which their own expert admits would leave the situation completely unchanged. HOW CAN SUCH A TEST BE ADOPTED AS THE LAW OF THE LAND, GOVERNING ALL MUNICIPAL BODIES?[59]

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[59] Obviously, no mathematical test or technique of analysis can encompass all real-world factors and considerations. However, at a minimum, courts should require that any test for determining differences in voting power incorporate and make use of all of the fixed "rules of the game" -- including, at a minimum, the number of votes each legislator may cast, and the size of his constituency -- and produce results which do not contradict common sense and everyday experience. The Banzhaf Index

CONCLUSION

Here the lower courts, relying solely upon figures produced using the Abate test, have determined that the disparities in voting power are unconstitutionally large, and cannot be justified by the factors cited by defendants below. An affirmance would not only require the Board to reapportion itself, but would also preclude New York City and countless other municipalities from using at-large members, flotorial district members, additional members elected from equal-size districts, and similar techniques to remedy the inequalities and still meet local needs.

Believing that the Abate test is illogical and unduly restrictive, and that a finding of unconstitutionality resting solely on it is insufficient to require reapportionment, Amicus respectfully urges this Court to remand, and to order the district court either to consider alternative analyses of voting

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meets those criteria, and the Abate test manifestly does not. It should not provide the sole and only support for invalidating NYC's Board of Estimate!

power using the Banzhaf Index, or to hold a hearing on its possible application.

In the alternative, since an analysis of the Board of Estimate using the Banzhaf Index appears in the record,[60] and is supported by defendants below, this Court may well find that the disparities in voting power are unconstitutionally large under either form of analysis. In such a case, Amicus respectfully urges the Court to affirm the finding of unconstitutionality, but to require the district court upon remand to consider plans which do not necessary meet the Abate test if there is other evidence that the plans reduce the disparities in voting power to acceptable limits.

Respectfully submitted,*

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* Consent of the parties to the filing of this amicus brief [Rule 36.2], and the certificate of service upon them [Rule 28.5], have been filed with the Clerk.

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60 See note 3, 831 F.2d 384, 386-87; REPRINTED, APPENDIX III.

APPENDIX I

BANZHAF VOTING POWER INDEX PROCEDURE FOR DETERMINING THE RELATIVE VOTING POWER OF INDIVIDUAL CITIZEN-VOTERS CONCERNING ANY LEGISLATIVE BODY

1. First, determine the relative voting strength of each member of the legislative body, i.e., the legislators. [For the sake of clarity only, this document will use the words "voting strength" to refer to legislators, and "voting power" to refer to citizen-voters. In each case the term refers to the ability of each (legislators or citizens) to affect outcomes through their votes.]

2. If each legislator has one vote, the relative voting strength of each legislator is one. If, however, the legislators have different numbers of votes (i.e., under a system of weighted voting), the relative voting strength of each legislator can be found only by determining the total number of different combinations of legislative votes which are possible, and then determining the percentage of such combinations in which each individual legislator could change the outcome by changing his vote. This usually requires computer calculations.

3. Second, with regard to each legislator, determine the number of people [citizen-voters] eligible to vote for that person. For a legislator who is elected at large, this number would be the total number of eligible voters. For legislators elected from districts, it would be the number of eligible voters in the district. For legislators elected

from boroughs, it would be the number of eligible voters in the borough electing the legislator.

4. Next, with regard to each legislator, divide the legislator's relative voting strength by the square root of the number of people eligible to vote for him. The result is the voting power of the citizen-voter with regard to each legislator for whom he is eligible to vote; i.e., "citizen voting power per legislator," or cvp/l.

5. Finally, to obtain the overall relative voting power of any individual citizen-voter -- i.e., the ability of any given citizen-voter to affect outcomes through his votes for all of the legislators he is able to vote for -- add (take the sum of) the cvp/l for each of the legislators for whom the citizen is eligible to vote.

6. For example, the relative voting power [RVP] of a citizen of any borough on the Board of Estimate as it is currently constituted would be calculated as follows:

cvp/l [Mayor] + cvp/l [Comp.] + cvp/l [Pres.] + cvp/l [bor. rep] = RVP

The first three terms -- the ability of each citizen-voter to affect outcomes by voting for the Mayor, the Comptroller, and the President of the City Counsel-- are obviously the same for all residents of New York City. The last term, however, will be different for each borough, and will be highest for Staten Island because the square root of the number of eligible voters in Staten

Island is far smaller than the square root of the number of eligible voters in the other boroughs.

7. As a further example, assume that there were to be added to the current membership of the Board of Estimate six [or any other number of] representatives each elected from districts within the city of equal population. Then the relative voting power [RVP] of each citizen-voter would be calculated as follows:

cvp/l [Mayor] + cvp/l [Comp.] + cvp/l [Pres.] + cvp/l [dist. rep] + cvp/l [bor. rep] = RVP

Here the first four terms would be equal, and the difference in the relative voting power of individual citizen-voters would lie only in the last term. This, in turn, could be made as small as possible (or necessary) either by increasing the number of votes of members of the Board other than the Borough representatives, or by increasing the number of members elected from districts of equal population.

8. It should be noted that the same technique can also be used to calculate the difference in citizen-voting power in conventional or simple reapportionment cases. Thus, in situations in which legislators each casting one vote are elected from districts of different sizes, the relative voting power of citizen voters in each district is equal to 1 divided by [the inverse of] the square root of the number of eligible voters in the district. In this ways the disparities in voting power between

individual citizen-voters in plans which have received (or been denied) judicial approval can be compared directly with the disparities in voting power between individual citizen-voters under the current or proposed Board of Estimate voting systems.

Banzhaf, Weighted Voting Doesn't Work: A Mathematical Analysis, 19 Rutgers L. Rev. 317 (1965)

Banzhaf, 3.312 Votes, A Mathematical Analysis of the Electoral College, 13 Villanova L. Rev. 303 (1968)

Banzhaf, Multi-Member Electoral Districts--Do They Violate the "One Man, One Vote" Principle?, 75 Yale L. J. 1309 (1966)

Banzhaf, One Man, ? Votes: Mathematical Analysis of Voting Power and Effective Representation, 36 Geo. W. L. Rev. 808 (1968)

Why Stein Plan for Board of Estimate Is Flawed

To the Editor:

The weighted-voting proposal for a new Board of Estimate by City Council President Andrew J. Stein (news story, Oct. 28) makes a mockery of the one-person, one-vote principle that it purportedly satisfies.

Under the proposal, each of the three citywide officials would have 35 votes, and the five borough presidents would have a total of 36 votes (from 1.8 votes for Staten Island to 11.3 votes for Brooklyn).

To obtain a simple majority of 71 of the 141 votes, two citywide officials and *any one* of the borough presidents could form a winning coalition; or one citywide official and *all* the borough presidents could form a winning coalition.

In either case, whether a borough president has 1.8 votes, 11.3, or anything in between, makes absolutely no difference in his or her ability to be a member of a winning coalition.

This renders all borough presidents, despite their different weights, equally powerful in forming a winning coalition. Indeed, if the 36 votes were divided by 5 to give them 6.6 votes each, the possible winning coalitions would be exactly the same as under the Stein proposal.

As an expert witness for the New York Civil Liberties Union in the Board of Estimate case, I proposed a set of weights that translate into voting power commensurate with the borough populations.

There are other means to satisfy the one-person, one-vote requirements that the Charter Revision Commission should consider. But if weighted voting is ultimately adopted, the weights — unlike those in the Stein proposal — should give the borough presidents voting power that reflects the different populations of their boroughs.

STEVEN J. BRAMS
Professor of Politics, New York Univ.
New York, Oct. 28, 1987

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APPENDIX III: BANZHAF ANALYSIS

CALCULATION OF DEVIATIONS IN CITIZEN VOTING POWER IN THE PRESENT NEW YORK CITY BOARD OF ESTIMATES [*sic*]

A. *Member, and Population Represented*	B. *Number Of Votes On Board*	C. *Member's Voting Power On Board*	D. *Citizen's Voting Power Thru 1 Member*	E. *Citizen's Total Voting Power*	F. *Percent Deviation Column E*
BROOKLYN 2,230,936	1	8.7	.00582	.0271	-5.15%
QUEENS 1,891,325	1	8.7	.00632	.0276	-3.37%
MANHATTAN 1,427,533	1	8.7	.00728	.0285	-0.25%
BRONX 1,169,115	1	8.7	.00805	.0293	+2.53%
STATEN I. 352,121	1	8.7	.01467	.0359	+25.65%
MAYOR 7,071,030	2	18.84	.00709	The total of these three figures, .021256, is added [to] the figures in Column D to calculate Colum E.	
COMP[TROLLER] 7,071,030	2	18.84	.00709		
COUN[CIL] PRES. 7,071,030	2	18.84	.00709		
AVERAGE DIST. 1,414,206	1	8.7	.00731	.02857	00

C.—Numbers in Column C are calculated using the Banzhaf voting power index.

D.—Numbers in Column D are calculated by dividing the figure in Column C by the square root of the population represented by each member, since the ability of a citizen voter to affect outcomes varies as the inverse [of] (1 divided by) the square root of the population.

E.—Numbers in Column E are calculated by adding to the figure in Column D for each borough representative, the voting power the citizen of the borough has through the three citywide representatives [3 × .00709 = .021256, excluding rounding error].

F.—Numbers in Column F are calculated by comparing the numbers in Column E with the corresponding figures for that of one of the average districts which would be formed if the non-citywide members were each elected from districts with equal population.